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MODIFICATION OF FORMULATIONS OF WAX POLISHES, LACQUER, RUST PREVENTIVE, RUBBING COMPOUND BY REPLACING LOW COST MATERIAL WITHOUT COMPROMISING ON PROPERTIES AND INTRODUCTION OF WAXES IN INCENSE STICKS FORMULATION

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ABSTRACT

The market of wax polishes, Lacquer, Rust Preventive, Rubbing Compound and incense sticks are growing at very fast rate. The demand of decorative products for interior designing and also for making wood articles is growing day by day. The competition in the market is growing and to sustain the businesses low cost alternative raw material is on growing demand. In case of incense sticks lasting fragrance is required and also the burning rate has to be slow. To deals with this problem we have introduced wax in the Incense sticks formulations to reduce the loss on evaporation. In our experiments we have studied different waxes for their properties by conventional methods and sophisticated methods like GC, FTIR & DSC and compared the properties of different waxes used in the wax polish industries and modified their formulations for cost effectiveness without hampering their properties. The formulation prepared was compared with traditional formulations for evaluation purpose.

The incense sticks are made by two methods one is by dipping the raw agarbatti sticks in fragrance compound and other is by adding the fragrance compound in the masala or incense paste and rolled on the bamboo stick by hand or machine and dried for 2 days and packed. The problems relating to the latter method i.e. adding fragrance compound in the masala was that when the incense sticks are kept for drying the ingredients in fragrance compound which has high evaporation rate gets evaporated hence reduces the smell on the incense sticks. The above problem has been solved by adding the Wax in the formulation.

KEYWORDS: Waxes, wax polishes, Incense sticks, sophisticated methods, Industries.

1. INTRODUCTION

Wax has been important in a variety of industries for a number of years. It has been used for everything from candles, polishes, and crayons to container coatings and impregnating paper. Much of this wax comes from petroleum. The commercial petroleum waxes may be divided into three principal groups: paraffin waxes, microcrystalline waxes and petrolatum. Petrolatum is a wax by-product obtained from certain types of heavy petroleum distillates or residues.

The term wax encompasses a broad range of naturally occurring and synthetic compounds constituted from high fatty acid esters (typically C36 - C50) or from polymers (700 < Molecular weight < 10,000). They differ from fats in that they are generally harder and less greasy.

Waxes exist in form of natural and synthetic substances. The natural ones can be divided into renewable and nonrenewable. The renewable waxes are regrowing and can be either chemically unmodified vegetable and animal based or can be chemically modified like hydrogenated or re-esterified types. The non-renewable fossil waxes are divided into crude or refined montan respectively petroleum waxes. Synthetic waxes exist as homo-

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polymers of Polyethylene, Polypropylene, Poly Alfa olefins, Fisher Tropes, Oxidates) and copolymers Epoxy Acrylate Styrene.

2. EXPERIMENTATIONS, OBSERCATIONS, RESULTS:

DSC measures the transition temperature of waxes. The operating temperature range extends from 15 to 150ºC. The DSC was carried out using ASTM D 4419. The experiment has been done using aluminium container heated at a controlled rate of 5ºC/Min in inert atmosphere.

The drop melting point of the wax carried out using ASTM D 127, Needle penetration of the wax was carried out using ASTM D 1321 and the Flash point of the samples was done by ASTM D 92. The congealing point was done by ASTM D 938 – 05) and melting point was done by ASTM D87 - 09(2014). The GC Properties was done by ASTM D 5442. The FTIR analysis have also been carried out. The observations have been tabulated in the following tables.

2.1OBSERVATION TABLE: Conventional & DSC properties of different Waxes:

Sr. No	Properties	FRPW	SRPW	SRMCW	FRMCW	BEE WAX	SHELLAC	CARNAUBA	CANDELLIA	PE	OPE
A	**Conventional Properties**										
1	R.I. @ 80˚C ASTM D 1218	1.426	1.429	1.444	1.443	1.434	1.439	1.448	1.451	1.437	1.454
2	Melting Point˚C ASTM D 87	61	65	78	80	68	80	83	72	114	99
3	Drop Melting Point˚C ASTM D 127	66	66	81	82	73	82	84	73	116	101
4	Cong. Point˚C ASTM D 938	62	63	76	78	66	79	82	70	113	98
5	Flash Point˚C ASTM D 92	208	212	224	226	230	235	280	240	230	220
6	Penet. Index @ 25˚C ASTM D 1312	1.2	1.0	1.4	1.2	1.4	1.5	1.4	1.5	0.4	0.6
B	**DSC Properties ASTM D 4419**										
1	Peak Temp.˚C	61.1	68.2	57.4	54.7	52.90	71.20	88.00	71.10	77.70	104.00

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2	Energy (j/g)	111	115	108	112	97.3	124	161	163	90.6	29.4
C	**GC Properties** ASTM D 5442										
	n-Paraffins (%)	74.713	76.418	68.754	42.061						
	Iso-Paraffins (%)	25.223	23.582	31.246	57.895						
B	**FT-IR**										
	The FTIR of all the waxes have been done and the various function groups present with their wavelength have been given.										

The melting point of four petroleum waxes and animal waxes by cooling curve method are more or less in the same range as by DSC method, whereas for plant waxes and synthetic waxes their values are different. DSC is a convenient and rapid method for determining the temperature limits within which these wax under goes thermal transitions. The highest thermal transition is a solid-liquid transition associated with complete melting, which can guide the choice of wax storage and application temperatures. The solid- solid temperature transition can be related to the properties of the wax about its hardness and blocking temperature.

The penetration index of all the four waxes, their values depends on their melting point but waxes having same melting point have different penetration index depending upon the oil content and the distribution of hydrocarbon in the respective wax.

The R.I. of MCW, animal, plant and synthetic waxes are higher than the paraffin wax.
FRPW, SRPW, SRMCW and FRMCW are respectively obtained from increasing order of boiling point and viscosity which are expected to give increasing order of flash point which agrees with our finding.

2.2Formulations Developments:
2.2.1Rubbing Compound:
The rubbing compound is used for removing thin layer of Oxidized paints from the surface.

Original Formulation:

Sr. No	Raw Materials	%
1	Carnauba Wax	25.29
2	Bees wax	10.65
3	Microcrystalline wax	3.99
4	Paraffin wax	6.66
5	Aliphatic hydrocarbon solvent	14.64
6	Water	14.64
7	Triethanolamine	0.31
8	Stearic Acid	1.20

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9	Al_2O_3	17.30
10	Fumed Silica	5.32
	Total	**100**

Trial Formulation:

Sr. No.	**Raw Materials**	**%**
1	Carnauba Wax	25.29
2	Bees wax	10.65
3	Semi refined Microcrystalline wax	3.99
4	Semi refined Paraffin wax	6.66
5	Aliphatic hydrocarbon solvent	14.64
6	Water	14.64
7	Triethanolamine	0.31
8	Stearic Acid	1.20
9	Al_2O_3	17.30
10	Fumed Silica	5.32
	Total	**100**

Manufacturing Process:
Melt the waxes and MTO in a Steam heated kettle. Add triethanolamine to water and heat to 95 Deg C. Add wax melt to water and mix till emulsified. After emulsification is complete add Al_2O_3 and fumed silica and stir. The above formula is used as a rubbing compound for paint and lacquers.

The above formula Removes thin layer of oxidized Paint and restores the shine / gloss of the paint.

Trials:
In this formulation the microcrystalline wax & Paraffin wax used were fully refined. We have carried out the trials using semi refined microcrystalline wax and Paraffin wax and we got almost same results as we were getting with the fully refined waxes.

2.2.2 Leather Polish:
This polish is used to polish the tanned leather to protect it from the moisture. The polish can be used for polishing leather and leather articles before and after stitching and designing.

Original Formulation:

Sr. No.	**Raw Material**	**%**
1	Carnauba wax	11
2	Turpentine	16
3	Stearic acid	3

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4	Oil soluble dye	2
5	Triethanolamine	1
6	Water	66
7	Water soluble dye	1
	Total	**100**

Trial Formulation:

Sr. No.	Raw Material	%
1	Carnauba wax	7
2	Paraffin wax	4
3	Turpentine	16
4	Stearic acid	3
5	Oil soluble dye	2
6	Triethanolamine	1
7	Water	66
8	Water soluble dye	1
	Total	**100**

Manufacturing Process:
Dissolve water soluble dye in water add the amine and stearic acid and heat it. In a separate kettle melt wax and add turpentine. After complete melting add dye to it. After complete mixing add wax mix to water soap solution and emulsify. Stir till cold.

Trials:
We have tried making this polish by reducing the percentage of Carnauba wax and adding to it Paraffin wax both fully refined and semi refined. The product manufactured using fully refined paraffin wax was equivalent in properties as it was with the pure Carnauba Wax.

2.2.3 Rust preventive:
These are used to protect the steel structures after they are manufactured. They are easy to apply on the surface and can be removed easily. They provide temporary prevention from rust on the steel surface.

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Original Formulation:

Sr. No.	Raw Material	%
1	Oxidized petrolatum	10
2	$Ca(OH)_2$	2
3	Mineral Oil	88
	Total	**100**

Trial Formulations:

Sr. No.	Raw Material	%
1	Oxidized petrolatum	8
2	$Ca(OH)_2$	2
3	Mineral Oil	88
4	Oxidized Polyethylene Wax	2
	Total	**100**

Manufacturing Process:
In a oil jacketed vessel heat the oxidized petrolatum. Add $Ca(OH)_2$ to melted petrolatum and increase the temperature to 180 Deg C . After the reaction is complete switch off the heat and add Mineral oil. Stir till cold.

Trials Results:
The Rust preventive made has been having the same properties as that of the original formulation and its applicability have become easier after adding OPE wax. The cost of the product has also gone down by using this formulation.

2.2.4 Wax polish for furniture and automobile.

Original formulation:

Sr. No.	Raw Material	%
1	Carnauba wax	7.14
2	Bees wax	10.71
3	Paraffin wax	14.29
4	Montan wax	3.57
5	Turpentine oil	14.29

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6	MTO	50.00
	Total	**100**

In a steam jacketed vessel, melt the wax mix. When a clear homogenous melt is observed, slowly add Turpentine oil, MTO and Low aromatic hydrocarbon solvent. Heat till entire mass is clear and homogenous. Cool till filling temperature, and fill it in containers.

Trial Formulation:

Sr. No.	**Raw Material**	**%**
1	Carnauba wax	7.14
2	Candelilla Wax	10.71
3	Paraffin wax	14.29
4	Montan wax	3.57
5	Turpentine oil	14.29
6	MTO	50.00
	Total	**100**

This Polish is used for shining the surfaces of the furniture's and automobiles. Shine on the surface of the material on which this coating was applied have given very smooth and shiny surface as compared to previous formulation.

2.2.5 Lacquer

Original Formulation:

Sr. No.	**Raw Material**	**%**
1	Orange Shellac	20
2	Alcohol	80
	Total	**100**

The above formula is conventional formula for Shellac Lacquer. The above formula gives a good shiny surface when applied to wood.

Trial Formulation:

Sr. No.	Raw Material	%
1	Orange Shellac	14
2	Alcohol	60
3	Carnauba wax	2

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4	Paraffin wax	1
5	Turpentine	23
	Total	**100**

Manufacturing Process:
Heat the mix of shellac and alcohol to 60 Deg C in a jacketed vessel. In another vessel with steam heating arrangement, heat the waxes and Turpentine to get a homogenous mix. Add wax mix to shellac mix and stir vigorously till cold.

The addition of waxes increases the shine of lacquer. It also helps in smooth application of lacquer.

2.2.6 Incense sticks Coating:
The burning of incense in religious and social functions have been practiced in India since early times. Dhup an aromatic powder or paste is burnt in Indian homes as a fragrant fumigant and is reputed to posses' insecticides and antiseptic properties.

The main raw material required for incense is bamboo sticks. The Sticks are either Square (not a precise cross section) or Round. The Mixture (Masala) is coated on to the sticks by either rolling with hand or by machine. The finest quality raw incense sticks can only be made by machine. More over the output of the machine is much higher than that of hand rolled incense sticks. The machine requires a polished and smooth bamboo stick for its proper functioning. The raw round sticks poses a problem in machine. The sticks are to be smooth and shiny in addition to that the friction while passing through the orifice of the machine should be less. The above problem was solved by dip coating the bamboo sticks in wax emulsion.

Trial Formulation I:

Sr. No.	Raw Material	%
1	Paraffin wax	25
2	Emulsifier	10
3	Water	65
	Total	**100**

The above formula gives a very smooth fluid wax emulsion. The bamboo sticks can be easily dipped in the emulsion to get a uniform coating. The coating smoothes the surface of the sticks, thus making it compatible with the modern machine.

Trial Formulation II:

Sr. No.	Raw Material	%
1	Paraffin wax	20
2	Microcrystalline wax	5
3	Emulsifier	10
4	Water	65
	Total	**100**

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The above formula gives better adhesion of wax to bamboo stick and also the wax coating is more tough and resistant to damages during handling.

Trials to reduce the evaporation rate of the Perfumes on Incense sticks:
The incense sticks are made by two methods one is by dipping the raw agarbatti sticks in fragrance compound and other is by adding the fragrance compound in the masala or incense paste and rolled on the bamboo stick by hand or machine and dried for 2 days and packed. The problems relating to the latter method i.e. adding fragrance compound in the masala was that when the incense sticks are kept for drying the ingredients in fragrance compound which has high evaporation rate gets evaporated hence reduces the smell on the incense sticks.

The above problem has been solved by adding the

Wax in the Mixture in two ways:
To solve this issue we have added wax with fragrance compound:

Sr. No.	Raw Material	%
1	Bees wax	0.9
2	Perfume compound	12.9
3	Incense paste	86.2
	Total	**100.0**

By adding wax the smell of incense sticks was as it is compared to without adding wax and also the evaporation was less.

Reducing absorption of Perfume on incense sticks in dipping method:
The incense sticks made of pure wood powder absorbs 40% by weight perfume compound which increases the cost of the product.

This problem was solved by adding wax in the masala.

Sr. No.	Raw Material	%
1	MC wax	1.5
2	Incense paste	98.5
	Total	**100**

By adding wax the absorption of the perfume compound was reduced to 35% by weight hence increasing the cost efficiency of product without disturbing the quality of fragrance and burning.

In all the above formulations we have tried to reduces the cost of production without compromising on the properties of the products or in other words without compromising on the quality of the products.

We have compared the properties of the waxes which was used in the existing formulations with the waxes which we have taken for studies. After comparing the properties we have changed the waxes in the formulations and by doing number of trials we have came to some formulations. In each products we have tried different

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formulations and the formulations which have given us the cost effective and good performance on actual application have been mentioned here.

3. CONCLUSION

The different properties of waxes gives the details about its working at different conditions. These properties were correlated with the different types of waxes. By detailed studies it can be said that if proper waxes are used the cost of product can be reduced which in turns can help in growth of any industries.

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